Climate Change AI

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Refining Ice Layer Tracking through Wavelet combined Neural Networks

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Introduction

- Ice layer tracking is essential to analyse and assess climate change
- Ice sheets are monitored through airborne radar sensors (Figure 1)
- Deep learning based edge detection networks have been successful in extracting ice layers [1]
- Radar images are noisy, and the algorithms predict extra edges at times
- Wavelet transform (WT) helps in denoising a signal

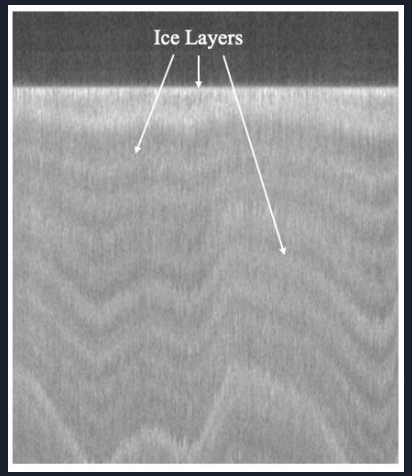
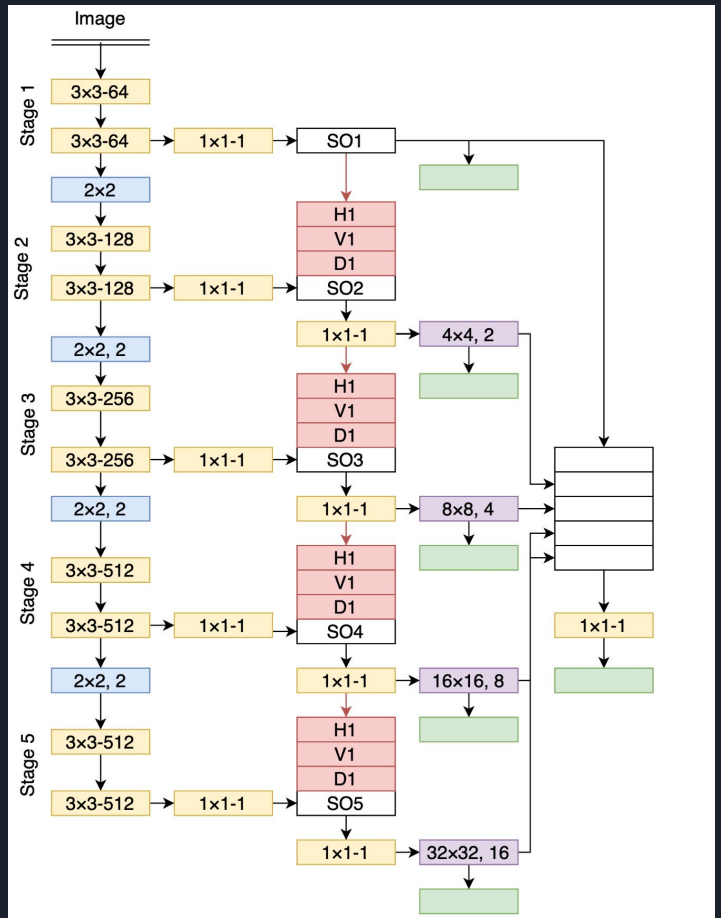


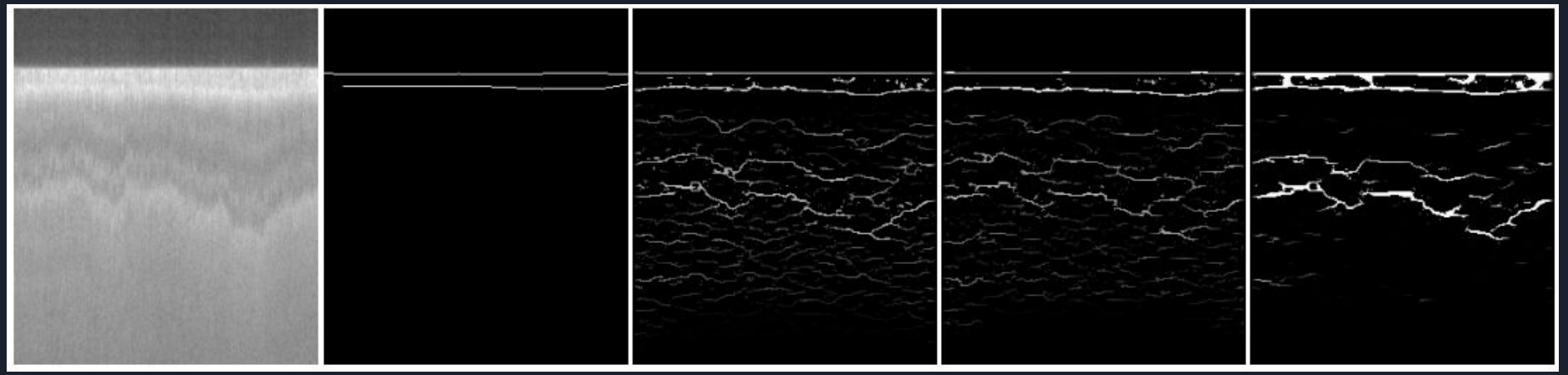
Figure 1

Methodology



- VGG 13 backbone
- WT of each side output is taken
- Detail coefficients are concatenated with the next stage's side output
- The entire network is deeply supervised

Results



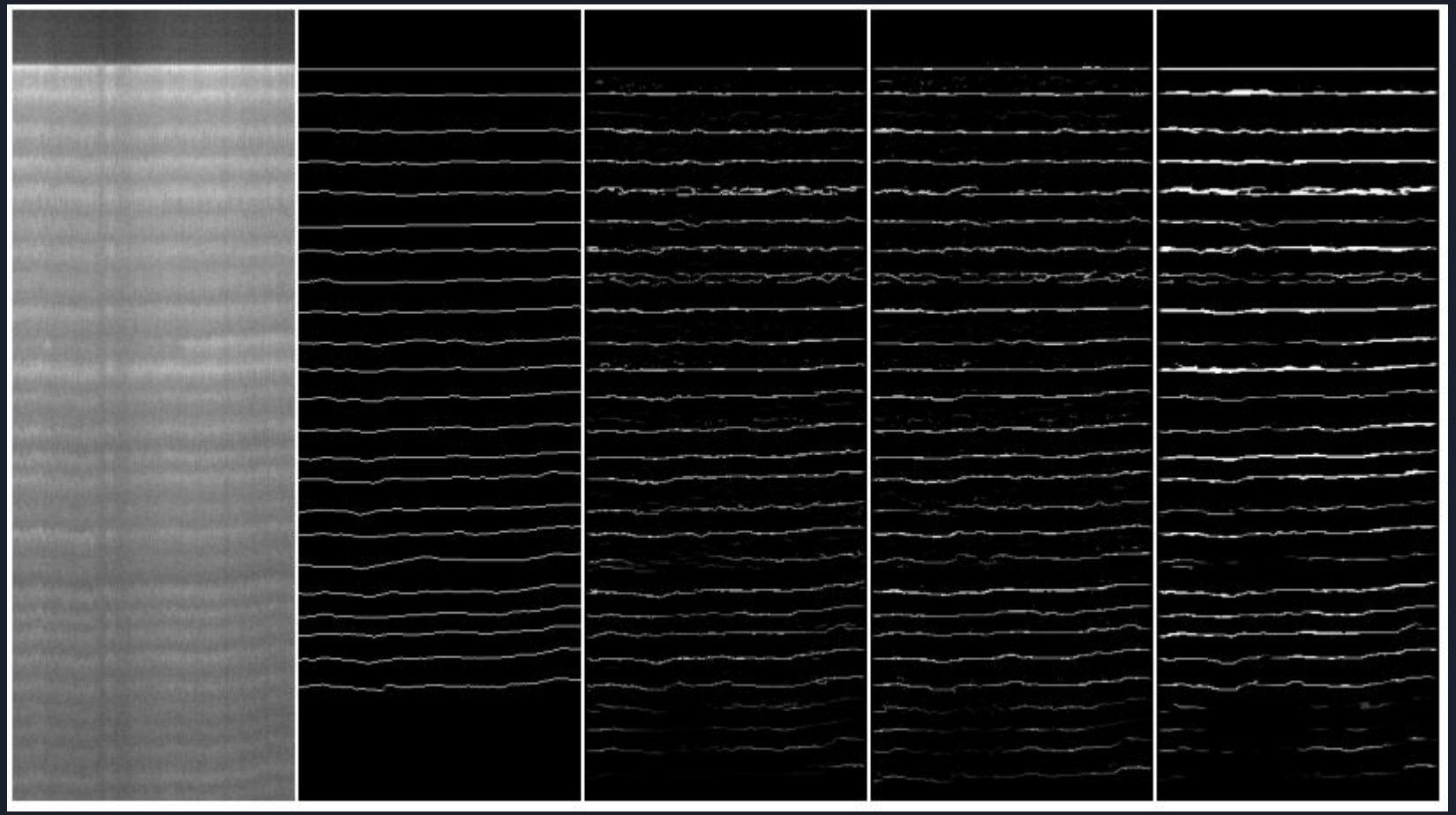
Radargram

(Incomplete)
Ground Truth

Base

Ours (haar)

Ours (debauchies)



Radargram | (Incomplete) Ground Truth | Base | Ours (haar) | Ours (debauchies)

Results

Network	Wavelet	ODS	OIS
Base	None	0.726	0.764
WT4	Haar	0.728	0.759
Ours	Haar	0.740	0.766
Ours	**Debauchies**	**0.746**	**0.780**

Table 1. ODS and OIS F-measures obtained by different networks

Conclusion

- Convolving on the detail coefficients of each scale helps in detecting deeper ice layers
- Wavelet transform helps in denoising and when combined with a convolutional layer helps in feature learning
- Method has potential to be used for tracking layers 2-3km deep

References

[1] M. Yari, M. Rahnemoonfar, J. Paden, I. Oluwanisola, L. Koenig and L. Montgomery, "Smart Tracking of Internal Layers of Ice in Radar Data via Multi-Scale Learning," 2019 IEEE International Conference on Big Data (Big Data), 2019, pp. 5462-5468, doi: 10.1109/BigData47090.2019.9006083.

Thank You

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